

REMARKS/ARGUMENTS

Favorable reconsideration of this application as currently amended and in view of the following remarks is respectfully requested.

Claims 1-6 are currently active in this case. Claims 1 and 3 have been amended and claim 6 has been added by the current amendment. No new matter had been added.

In the outstanding office action, claims 1 and 3 were objected to; claim 1 was rejected on the ground of obviousness type double patenting as being unpatentable over claims 4 and 5 of USP 6,494,842 in view of USP 5,345,426 to Lipschutz or in the alternative USP 5,623,928 to Wright et al.; claim 1 was rejected under 35 USC 112, first paragraph, as failing the enablement requirement; claims 1 and 3-5 were rejected under 35 USC 102(b) as anticipated by Lipschutz; claims 1-3 and 5 were rejected as anticipated by USP 5,905,692 to Dolazza et al.; claim 3 was rejected as unpatentable over Lipschutz in view of Dolazza et al.; and claim 4 was rejected as unpatentable over Dolazza et al. in view of Freeman et al.

In response to the objection to claims 1 and 3, those claims have been amended to address the antecedent basis issue identified in the office action. Consequently, no further objection to claims 1 and 3 is anticipated.

Applicants have submitted herewith a terminal disclaimer in order to overcome the obviousness type double patenting rejection.

Claim 1 has been rejected under 35 USC 112, first paragraph, as failing the enablement requirement. Applicants respectfully traverse. The official action fails to construe the scope of the claims. Consequently, the office action has not made a *prima facie* case that the Applicants' specification fails to enable the claims. *Genentech v. Wellcome Foundation*, 29 F.3d 1555, 1563-64, 31 USPQ2d 1161, 1167-68 (Fed. Cir. 1994). Each of the office action's arguments are addressed below. Regarding points (A) and (B) of the office action, Applicants respectfully point out that the breadth of the claim terms of the

instant application should not be construed narrowly in view of non-related patents or patent applications. Further, Applicants respectfully point out that the claims of the instant application do not recite the term "beamformation."

Further regarding point (a) of the office action, the present invention relates to a digital receive-focusing apparatus for use in an ultrasound imaging system (see the preamble of claim 1). More particularly, and by way of non-limiting example, the present invention is directed to a digital receive-focusing apparatus configured to process, at a channel module, ultrasound signals originating from at least two ultrasound channels using a multiplexer. Therefore, even when the ultrasound signals are input from multiple channels (e.g., 8 channels) greater than the numbers of channel modules (e.g. 4 channel modules), the digital receive-focusing apparatus of the present invention can form multiple receive beams (e.g., 4 beams). That is, the digital receive-focusing apparatus of the present invention can operate in a multi-channel multi-beam mode, as described at paragraph [0016], lines 3-6 of the Specification.

The official action asserts in point (B) that the terminology "beamform" does not appear in the application. Applicants respectfully submit that it is well known in the ultrasound imaging art that receive beamforming is the process of focusing receive signals in order to form a receive-focused beam. The receive-focusing apparatus of the present invention is for producing a receive-focused beam.

The official action asserts in point (C) that there is no indication as to how or whether the clocking controls to the FIFOs from FDCU 28 control the input multiplexers 21 {sic; 22}. In response, Applicants respectfully point out that the ultrasound image system of the present invention is a digital system. The multiplexer 22 of the invention operates under the control of the system clock as described in paragraph [0010], lines 2-5 of the Specification. That is, the FDCU 28 does not control the multiplexer 22, but rather the FIFOs 27. Further, as

described in paragraph [0011] of the Specification, the FDCU 28 controls the FIFOs based on pre-calculated amounts of delay which are determined by the rate of switching at the multiplexer 22.

The official action asserts in point (D) that exemplary pulse timing diagrams are wholly lacking. Applicants respectfully point out that the Specification is not required to contain working examples in order to comply with the enablement requirement. In re Borkowski, 422 F.2d 904, 908, 164 USPQ 642, 645 (CCPA 1970). That is, the subject matter of the present invention relates to employing a multiplexer in order to reduce the number of channel modules. The operation of the multiplexer would have been well known to a person skilled in the art without reference to exemplary pulse timing diagrams.

The official action asserts in point (E) that there is no explanation of why 5 stages of delay FIFOs are needed. In response, Applicants point out that it is well known that a plurality of delays is required in order to receive-focus digital signals input through a plurality of channels. In accordance with the preferred, but non-limiting, embodiment of the present invention, 5 stages of delays (FIFOs) are employed as the delays. However, the number of delays does not have to be limited to 5. For example, it would be understood from the Specification with regard to the 5 stages of delay FIFOs, a first stage of FIFO 25 is a delay for simultaneously outputting the digital signals originated from at least two channels to a second stage FIFOs 26 as described in paragraph [0011], lines 7-9 of the Specification. The first stage of FIFO 25 could be omitted in accordance with another embodiment of the present invention. A second stage of FIFOs 27 delay the digital signals based on the rate of switching at analogue multiplexer 22, as described in paragraph [0011], lines 10-16 of the Specification. A third stage of FIFO 30 delay the digital data from a FIR filter & MUX 29 to focus the delay. Finally, fourth and fifth stages of FIFOs 38 and 40 delay the digital data output from the channel modules 21. The fourth and fifth stages of FIFOs could be embodied

in one stage of FIFO in accordance with another embodiment of the present invention. Thus, the present invention is not limited to an embodiment utilizing 5 stages of FIFOs.

The official action asserts in point (F) that a relationship between the multiplexer and the transducers is never established. Applicants respectfully point out that such a relationship is not claimed. Consequently, enablement of such a relationship is not required. However, Applicants submit that the relationship of the multiplexer and transducer is understood from the Specification. Transducers are discussed in the abstract (paragraph [0003]).

Additionally, it would have been understood by a person of ordinary skill in the art that the term 'channel' as used in the specification and stated in the claims refers to, by way of non-limiting example, a 'transducer element' of a transducer array. Thus, because the multiplexer 22 receives ultrasound signals from the channels, it is understood that the multiplexer 22 is connected to the transducer.

For the foregoing reasons, Applicants respectfully submit that the scope of enablement provided by the specification is commensurate with the scope of the claims.

Regarding Lipschutz, the official action asserts that the multiplexers 102 and 106 correspond to the multiplexing means of the present invention. Applicants respectfully traverse. Fig. 3 of Lipschutz is a block diagram of a delay interpolator 24 illustrated in Figure 1. That is, the multiplexers 102 and 106 of Lipschutz form a part of the delay interpolator. As described in Col. 4, lines 35-44 of Lipschutz, the delay interpolator 24 delays a digital sample for each channel. See also Figure 1 which reflects that the delay interpolator 24 is located after the analog to digital converter 20. In contrast thereto, the multiplexing means of the present invention does not delay a digital sample but rather multiplexes ultrasound signals originating from at least two ultrasound channels. The delay interpolator including the multiplexers 102 and 106 of Lipschutz corresponds to FIR filter &

MUX of the present invention. Thus, Lipschutz is not believed to anticipate or render obvious the subject matter defined by claim 1.

Regarding Dolazza et al., the official action asserts that the switching network corresponds to the multiplexing means of the present invention. Applicants respectfully traverse. As described in Col. 2, lines 31-35 of Dolazza et al., the switching network is used to sequentially process the signals of transducers from multiple regions of the transducer array at a set of processing channels. That is, the transducer array of Dolazza et al. is divided into multiple regions, each region having a plurality of transducers, and each region is sequentially activated for ultrasound transmission and reception. In this case, the transducers included in the activated region have to be connected to the processing channels. The switching network sequentially connects the transducers included in the activated region to process channels. However, the multiplexing means of the present invention does not connect transducers provided in a sequentially activated region to the processing channels, but rather multiplexes (alternately connects) at least two channels to one channel module. Thus, the multiplexing means of the present invention is clearly distinguishable from the switching network, and Dolazza et al. are not believed to anticipate or render obvious the subject matter defined by claim 1.

Newly added claim 6 defines, among other things, an analogue multiplexer configured to multiplex ultrasound signals originating from at least two ultrasound channels. Thus, claim 6 is believed to be allowable for at least the same reasons that claim 1 is believed to be allowable. Dependent claims 2-5 are also believed to be allowable for at least the same reasons that claim 1 is believed to be allowable.

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In view of the foregoing, no further issues are believed to remain. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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